Appendix A – Detailed Description of Watershed Restoration Actions

GOAL 1: *Protect and enhance late-successional and old-growth forest ecosystems.*

OBJECTIVE: On decommissioned and BLM-controlled roads, control noxious weeds within 10 years sufficient to ensure they do not penetrate into late-successional stands.

ACTION: Inventory roads within or adjacent to late-successional stands for the presence of noxious weeds.

ACTION: Remove noxious weeds from BLM-controlled roads, including roads to be decommissioned.

ACTION: Plant trees or other native species in the decommissioned roads to prevent noxious weeds from becoming established in areas where weed seed is likely to spread into the decommissioned roads.

GUIDELINES:

- Use methods to remove weeds such as steam treatment, mowing, pulling, cutting and grubbing depending on the weed species.

MITIGATION MEASURES:

- Do not conduct weed removal treatments with power tools or machinery during the critical northern spotted owl nesting season (March 1 – July 7).

OBJECTIVE: Decommission all non-shared, BLM-controlled roads within or adjacent to late-successional stands within 10 years.

ACTION: Decommission the roads shown in Appendix E of the EIS.

GUIDELINES:

- In determining the timing for decommissioning, consider whether the road would provide access for other management actions.
- Road segments shown for decommissioning in Appendix E of the EIS are approximate and may be modified slightly to improve the effectiveness of decommissioning or facilitate other restoration actions.

ACTION: Decommission unnumbered roads and non-designated trails as needed to protect and enhance late-successional forests.

ACTION: On roads to be decommissioned, break up areas of soil compaction of the road surface (by subsoiling or other such methods) as needed to allow tree establishment and growth.

GUIDELINES:

- Where subsoiling or other such methods will not be sufficient to allow tree

establishment and growth, recontour the road area to create better tree growing conditions.

- Coordinate thinning and coarse woody debris creation in adjacent stands to fall some trees across decommissioned roads to cover soil and block access.

ACTION: Plant trees or other native species on the decommissioned road surface when needed to ensure tree establishment.

ACTION: Block decommissioned roads as needed to restrict vehicular traffic.

GOAL 2: *Foster the development of late-successional forest structure and composition in plantations and young forests within LSR 267.*

OBJECTIVE: Reduce tree density and increase variability of tree spacing in 90% (100% of stands; 90% of acres) of the 1-20 year age class that has not been pre-commercially thinned, so that tree densities range from 75-150 TPA within 10 years.

ACTION: Thin approximately 1/3 of stands aged 11 to 20 years to a stand average of 75-100 Douglas-fir trees per acre.

ACTION: Thin approximately 1/3 of stands aged 11 to 20 years to a stand average of 100-120 Douglas-fir trees per acre.

ACTION: Thin approximately 1/3 of stands aged 11 to 20 years to a stand average of 120-150 Douglas-fir trees per acre.

GUIDELINES:

- Select only Douglas-fir for cutting.
- Select the largest, healthiest trees for retention, regardless of spacing.
- Leave most or all cut trees in the stand. Some removal may be needed to mitigate fire risk in limited locations, such as near roads.
- Generally apply the lower density prescriptions to the older stands within the age class.

MITIGATION MEASURES:

- Along areas (such as roadsides and adjacent clearcuts) with noxious weed problems, do not thin along edge (approximately 10' - 25') of stands to restrict spread of noxious weeds. Some tree cutting will be necessary to provide operational access.

OBJECTIVE: Reduce tree density and increase variability of tree spacing in 90% (100% of stands; 90% of acres) of the 1-20 year age class that has been pre-commercially thinned, so that tree densities range from 40-60 TPA within 10 years.

ACTION: Thin stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

GUIDELINES:

- Select only Douglas-fir for cutting.
- Thin from below: select the largest, most vigorous trees for retention within approximately even spacing to maximize individual tree growth.
- Generally leave all cut trees in the stand. Some removal may be needed to mitigate fire risk in limited locations, such as near roads.
- Target stand densities should be reached after completion of coarse woody debris and snag creation done under objectives below.
- Generally apply thinning more than 8 years after pre-commercial thinning.

MITIGATION MEASURES:

- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Do not thin within the primary shade zone (except for approximately 1-2 trees per acre which may be felled for large woody debris in streams).
- Limit the cutting of trees >12" dbh to lessen the risk of Douglas-fir bark beetle infestation. (Some trees >12" dbh will be specifically selected for snag and/or coarse woody debris creation).
- Lessen fire risk from thinning by not creating high fuel loads near roads. Appropriate mitigations include measures such as removing cut trees from the stand; pulling-back cut trees from road edge; hand-piling and burning cut trees; or leaving part of the stand unthinned. Do not conduct burning during the nesting period for northern spotted owls or marbled murrelets.

OBJECTIVE: **Reduce tree density and increase variability of tree spacing in 75% (100% of stands; 75% of acres) of the 21-30-year age class, so that tree densities range from 40-110 TPA within 10 years.**

ACTION: Among stands aged 21 to 30 years, thin 75% of acres of Douglas-fir stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

GUIDELINES:

- Select only Douglas-fir for cutting.
- Thin from below: select the largest, most vigorous trees for retention within approximately even spacing to maximize individual tree growth.
- Generally leave all cut trees in the stand. Some removal may be needed to mitigate fire risk in limited locations, such as near roads.
- Target stand densities should be reached after completion of coarse woody debris and snag creation done under objectives below.

MITIGATION MEASURES:

- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Limit falling of trees directly into streams to approximately 160 trees per stream mile (though this average quantity would likely be very unevenly distributed along any particular stream reach).
- Avoid creating large concentration of fallen trees with intact needles or leaves in stream reaches with poor oxygen reaeration (e.g., high water temperatures, low stream gradient, very slow moving water) during seasons of low stream flow (summer and early fall).
- Maintain sufficient stream shading so as to avoid contributing to increased water temperature. Do not thin within the primary shade zone (except for approximately 1-2 trees per acre which may be felled for large woody debris in streams).
- Limit the cutting of trees >12" dbh to lessen the risk of Douglas-fir bark beetle infestation. (Some trees >12" dbh will be specifically selected for snag and/or coarse

woody debris creation).

- Lessen fire risk from thinning by not creating high fuel loads near roads. Appropriate mitigations include measures such as removing cut trees from the stand; pulling-back cut trees from road edge; hand-piling and burning cut trees; or leaving part of the stand unthinned. Do not conduct burning during the nesting period for northern spotted owls or marbled murrelets.

- Along areas (such as roadsides and adjacent clearcuts) with noxious weed problems, do not thin along edge (approximately 10'- 25') of stands to restrict spread of noxious weeds. Some tree cutting will be necessary to provide operational access.

OBJECTIVE: Reduce tree density and increase variability of tree spacing in 50% (100% of stands; 50% of acres) of the 31-50-year age class, so that tree densities range from 40-110 TPA within 10 years.

ACTION: Among stands aged 31 to 50 years, thin 50% of acres of Douglas-fir stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

GUIDELINES:

- Select only Douglas-fir for cutting.
- Thin from below: select the largest, most vigorous trees for retention within approximately even spacing to maximize individual tree growth.
- Generally leave all cut trees in the stand. Some removal may be needed to mitigate fire risk in limited locations, such as near roads.
- Target stand densities should be reached after completion of coarse woody debris and snag creation done under objectives below.

MITIGATION MEASURES:

- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Limit falling of trees directly into streams to approximately 160 trees per stream mile (though this average quantity would likely be very unevenly distributed along any particular stream reach).
- Avoid creating large concentration of fallen trees with intact needles or leaves in stream reaches with poor oxygen reaeration (e.g., high water temperatures, low stream gradient, very slow moving water) during seasons of low stream flow (summer and early fall).
- Generally limit the cutting of trees >12" dbh to lessen the risk of Douglas-fir bark beetle infestation. (Some trees >12" dbh will be specifically selected for snag and/or coarse woody debris creation). Where some cutting of trees >12" dbh would be needed to achieve target stand densities, lessen the risk of Douglas-fir bark beetle infestation by falling trees in the summer, removing some cut trees, or leaving part of the stand unthinned.
- Maintain sufficient stream shading so as to avoid contributing to increased water temperature. Do not thin within the primary shade zone (except for approximately 1-2 trees per acre which may be felled for large woody debris in streams).
- Lessen fire risk from thinning by not creating high fuel loads near roads. Appropriate mitigations include measures such as removing cut trees from the stand; pulling-back cut trees from road edge; hand-piling and burning cut trees; or leaving part of the stand unthinned. Do not conduct burning during the nesting period for northern spotted owls or marbled murrelets.
- Along areas (such as roadsides and adjacent clearcuts) with noxious weed problems, do not thin along edge (approximately 10'- 25') of stands to restrict spread of noxious

weeds. Some tree cutting will be necessary to provide operational access.

OBJECTIVE: Reduce tree density and increase variability of tree spacing in 25% (50% of stands; 50% of acres) of the 51-60-year age class, so that tree densities range from 40-110 TPA within 10 years.

ACTION: Among stands aged 51 to 60 years, thin 25% of Douglas-fir stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

GUIDELINES:

- Select only Douglas-fir for cutting.
- Thin from below: select the largest, most vigorous trees for retention within approximately even spacing to maximize individual tree growth. (In addition to the thinning prescription, fall or pull trees if available to provide stable in-stream structure (generally 0.6 TPA ≥24"dbh)).
- Leave all cut trees in the stand.
- Target stand densities should be reached after completion of coarse woody debris and snag creation done under objectives below.

MITIGATION MEASURES:

- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Limit falling of trees directly into streams to approximately 160 trees per stream mile (though this average quantity would likely be very unevenly distributed along any particular stream reach).
- Avoid creating large concentration of fallen trees with intact needles or leaves in stream reaches with poor oxygen reaeration (e.g., high water temperatures, low stream gradient, very slow moving water) during seasons of low stream flow (summer and early fall).
- Maintain sufficient stream shading so as to avoid contributing to increased water temperature. Do not thin within the primary shade zone (except for approximately 1-2 trees per acre which may be felled for large woody debris in streams).
- Generally limit the cutting of trees >12" dbh to lessen the risk of Douglas-fir bark beetle infestation. (Some trees >12" dbh will be specifically selected for snag and/or coarse woody debris creation). Where some cutting of trees >12" dbh would be needed to achieve target stand densities, lessen the risk of Douglas-fir bark beetle infestation by falling trees in the summer, removing some cut trees, or leaving part of the stand unthinned.
- Lessen fire risk from thinning by not creating high fuel loads near roads. Appropriate mitigations include measures such as removing cut trees from the stand; pulling-back cut trees from road edge; hand-piling and burning cut trees; or leaving part of the stand unthinned. Do not conduct burning during the nesting period for northern spotted owls or marbled murrelets.
- Along areas (such as roadsides and adjacent clearcuts) with noxious weed problems, do not thin along edge (approximately 10'- 25') of stands to restrict spread of noxious weeds. Some tree cutting will be necessary to provide operational access.
- Evaluate stands ≥51 years old with older remnant trees for potential marbled murrelet habitat. Survey potential habitat or leave untreated.
- Do not thin within current owl home ranges that currently have less than 40% suitable habitat.

OBJECTIVE: In stands treated under the above objectives, develop densities of shade-

tolerant conifers to ensure that by age 81, they contain densities similar to those found in mature natural stands (26-90 TPA >2" dbh).

ACTION: Within stands that are thinned to below 110 TPA at ages 21-30 and lack sufficient shade-tolerant conifer trees or seedlings to meet the objective, plant seedlings of shade-tolerant conifers (western hemlock, western red-cedar, grand fir, incense-cedar and/or Pacific yew) at densities of 26-200 trees per acre.

ACTION: Within stands that are thinned to below 80 TPA at ages 31-60 and lack sufficient shade-tolerant conifer trees or seedlings to meet the objective, plant seedlings of shade-tolerant conifers (western hemlock, western red-cedar, grand fir, incense-cedar and/or Pacific yew) at densities of 26-200 trees per acre.

GUIDELINES:

- Give preference in planting to areas with the greatest likelihood of seedling establishment and growth, considering factors such as post-thinning overstory density and shrub competition.
- Planting may be concentrated in distribution in response to site-specific conditions and need not be evenly distributed across the stand. Planting densities should generally be met at the scale of 20 acres (e.g., 520-4,000 trees/20 acres).

GOAL 3: *Reconnect streams and reconnect stream channels to their riparian zones and upslope areas within LSR 267.*

OBJECTIVE: Decommission or improve all roads capable of delivering sediment to streams, as identified in watershed analysis within 10 years.

ACTION: Decommission the roads shown in Appendix E.

GUIDELINES:

- Decommissioning may include any of the following measures:
  - discontinuing road maintenance;
  - tilling the road surface with dozer and subsoiler implement or a track mounted excavator;
  - removing gravel or pulling of gravel into the ditch line;
  - scarifying roads for creation of planting areas;
  - removing side cast soils from fill slopes with a high potential for triggering landslides;
  - filling and contouring of cut slope ditch lines to the adjacent hill slope;
  - removing culverts;
  - stabilizing stream crossings (e.g., recountering stream channels, placement of mulch or mats and seeding for erosion control, placement of rock and logs);
  - installing water bars, cross sloping or drainage dips to ensure adequate drainage into vegetated areas and away from streams or unstable road fills;
  - blocking the road using barricades, gating, or earth berm barriers;
  - placing slash, boulders, and/or woody debris on the road surface to deflect runoff, discourage OHV use, and promote vegetative growth;
  - seeding or planting for erosion control.
- Along roads being decommissioned, generally remove culverts and recontour stream channel to achieve streambank stability.

ACTION: On roads to be decommissioned, break up areas of soil compaction of the road surface (by subsoiling or other such methods) as needed to allow tree establishment and growth.

GUIDELINES:

- Where subsoiling or other such methods will not be sufficient to allow tree establishment and growth, recontour the road area to create better tree growing conditions.
- Coordinate thinning and coarse woody debris creation in adjacent stands to fall some trees across decommissioned roads to cover soil and block access.

ACTION: Plant trees or other native species on decommissioned road surface when needed to ensure tree establishment.

ACTION: Block decommissioned road as needed to restrict vehicular traffic.

OBJECTIVE: On roads that will not be decommissioned, reduce the risk to the aquatic ecosystem attributable to the road network within 10 years.

ACTION: Eliminate all barriers to movements of anadromous fish attributable to BLM-controlled roads.

GUIDELINES:

- Barriers may be eliminated by removal, replacement, or modification of culverts, and/or installation of downstream structures to raise upstream water levels within culverts or upstream structure to stabilize accumulated deposition.

ACTION: Develop and implement Memoranda of Understanding with adjacent road- and land-owners to eliminate barriers to movements of anadromous fish attributable to non-BLM roads or lands.

ACTION: Remove or replace culverts that have a high risk of failure.

GUIDELINES:

- Along roads that will not be decommissioned, replace existing culverts that are failed, undersized, or constitute passage barriers. An existing culvert may be replaced with another culvert, a half-arch or a bridge.
- For culverts creating a passage barrier, where removal or replacement are not feasible, access to the culvert may be created or improved by downstream log or boulder structure designed to elevate the stream channel and create pools to facilitate movement into the culvert. Downstream structures may also be used in conjunction with culvert replacement to improve passage.

OBJECTIVE: Increase stream structure to >160 pieces/stream mile of woody debris (>6"diameter, 10' long) on all 1st and 2nd order streams adjacent to stands ≤80 years old, and >30 structures/stream mile along 3.8 miles of 3rd, 4th, or 5th-order streams within 10 years.

ACTION: Construct woody debris structures with at least 3 key pieces/structure in 3rd, 4th, or 5th-order streams.

GUIDELINES:

- Key pieces should generally be greater than 50' long and ≥24" diameter.
- Cable or otherwise stabilize structures as needed in streams that are devoid of existing stable structure that has the potential to accumulate future woody debris recruitment.
- Consider yarding logs into the stream from nearby thinning operations. Do not use helicopters for yarding logs into streams.
- Wood imported from off-site (e.g., purchased logs or any other logs not from adjacent or nearby stands) should generally be used in structures on 4th and 5th-order streams.

ACTION: In riparian stands ≤80 years old that are not thinned under the thinning objective below, fall or pull over trees into the stream to increase levels to >160 pieces/stream mile of woody debris (>6"diameter, 10' long).

GUIDELINES:

- On streams with no existing woody debris, cut 160 trees >6" dbh/stream mile (approximately 25 trees/acre). If available, fall or pull trees to provide stable in-stream structure (generally 0.6 TPA ≥24"dbh).
- In conifer-dominated stands, generally select Douglas-fir for falling or pulling. In hardwood-dominated stands, generally select red alder and bigleaf maple for falling or cutting
- In conifer-dominated stands, generally do not fall or pull more than one tree/acre from the largest 10% of diameter classes in the stand.
- In hardwood-dominated stands, some conifers may be felled or pulled, but generally do not fall or pull more than half of the conifer trees (at the scale of one acre).

MITIGATION MEASURES:

- Do not fall or pull conifers ≥32" dbh.
- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Maintain sufficient stream shading so as to avoid contributing to increased water temperature. Do not thin within the primary shade zone (except for approximately 1-2 trees per acre which may be felled for large woody debris in streams).

OBJECTIVE: In 55% of riparian (<100' from stream) Douglas-fir stands 21-60 years old, attain conifer densities of ³13 TPA ³24" dbh by age 80.

ACTION: Among stands aged 21 to 30 years, thin 75% of acres of Douglas-fir stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

ACTION: Among stands aged 31 to 50 years, thin 50% of acres of Douglas-fir stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

ACTION: Among stands aged 51 to 60 years, thin 25% of Douglas-fir stands in riparian zone (i.e., <100' from streams) to a treated stand average of 60-110 Douglas-fir trees per acre.

GUIDELINES:

- Select only Douglas-fir for cutting.
- Thin from below: select the largest, most vigorous trees for retention within approximately even spacing to maximize individual tree growth.
- Generally leave all cut trees in the stand. Some removal may be needed to mitigate risk in limited locations, such as near roads.

MITIGATION MEASURES:

- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Limit falling of trees directly into streams to approximately 160 trees per stream mile (though this average quantity would likely be very unevenly distributed along any particular stream reach).
- Avoid creating large concentration of fallen trees with intact needles or leaves in stream reaches with poor oxygen reaeration (e.g., high water temperatures, low stream gradient, very slow moving water) during seasons of low stream flow (summer and early fall).
- Maintain sufficient stream shading so as to avoid contributing to increased water temperature.
- Generally limit the cutting of trees >12" dbh to lessen the risk of Douglas-fir bark beetle infestation. (Some trees >12" dbh will be specifically selected for snag and/or coarse woody debris creation). Where some cutting of trees >12" dbh would be needed to achieve target stand densities, lessen the risk of Douglas-fir bark beetle infestation by falling trees in the summer, removing some cut trees, or leaving part of the stand unthinned.
- Lessen fire risk from thinning by not creating high fuel loads near roads. Appropriate mitigations include measures such as removing cut trees from the stand; pulling-back cut trees from road edge; hand-piling and burning cut trees; or leaving part of the stand unthinned. Do not conduct burning during the nesting period for northern spotted owls or marbled murrelets.

OBJECTIVE: **In 50% of riparian (<100' from stream) hardwood-dominated stands, attain conifer densities of ³13 TPA ³24"dbh by age 101-131 (or approximately 80 years after treatment).**

ACTION: Cut hardwoods and shrubs to provide growing space for conifers in hardwood-dominated stands in riparian zone (i.e., <100' from streams).

GUIDELINES:

- Cut or girdle competing hardwoods and shrubs to release existing conifer saplings or to create planting sites for conifers
- Select for cutting primarily red alder and tall shrubs, such as salmonberry, that compete aggressively with conifer saplings.
- Some trees may be girdled instead of cut to create snags.

MITIGATION MEASURES:

- Do not cut trees on immediate streambank that are contributing to streambank stability.
- Limit falling of trees directly into streams to approximately 160 trees per stream mile (though this average quantity would likely be very unevenly distributed along any particular stream reach).
- Avoid creating large concentration of fallen trees with intact needles or leaves in stream reaches with poor oxygen reaeration (e.g., high water temperatures, low stream gradient, very slow moving water) during seasons of low stream flow (summer and early fall).
- Maintain sufficient stream shading so as to avoid contributing to increased water temperature. Do not thin within the primary shade zone (except for approximately 1-2 trees per acre which may be felled for large woody debris in streams).

ACTION: Plant conifer seedlings and/or saplings in hardwood-dominated stands that were

treated under the previous action and lack sufficient conifers to meet objective densities.

GUIDELINES:

- Species planted will be primarily western red-cedar and Douglas-fir, but may also include western hemlock and grand fir, depending on specific site conditions.
- Give preference in planting to areas with the greatest likelihood of conifer establishment and growth, considering factors such as soil conditions, overstory density and shrub competition.
- Planting may be concentrated in distribution in response to site-specific conditions and need not be evenly distributed across the stand.
- Tube western red-cedar seedlings to reduce browsing.
- Control competing shrub vegetation by placing mats or mulch around the trees or by cutting competing shrubs at planting and during subsequent years as needed to establish trees.